

Claims

What is claimed is:

A wireless communication device comprising:

a communication electronics;

5 a first loop conductor antenna operating at a first frequency, said first loop conductor antenna operatively connected to said communication electronics;

a second loop conductor antenna operating at a second frequency, said second loop conductor antenna operatively connected to said communication electronics; and

10 a pole antenna operating at a third frequency, said pole antenna operatively connected to said communication electronics;

said communication electronics selectively communicating with a remotely positioned interrogator through one of said antennas.

15 2. The wireless communication device of claim 1, wherein said first loop conductor antenna operating at a first frequency comprises a first loop conductor antenna operating at 868 MHz.

3. The wireless communication device of claim 1, wherein said first loop conductor antenna operating at a first frequency comprises a first loop conductor antenna operating at 13.56 MHz.

20 4. The wireless communication device of claim 1, further comprising a third loop conductor antenna operating at a fourth frequency.

5. The wireless communication device of claim 4, wherein said first loop conductor antenna, said second loop conductor antenna, and said third loop conductor antenna share a loop conductor.

6. The wireless communication device of claim 5, wherein said first loop conductor antenna operates at 868 MHz, said second loop conductor antenna operates at 915 MHz, and said third loop conductor antenna operates at 13.56 MHz.

7. The wireless communication device of claim 1, wherein said pole antenna operates at 2.45 GHz.

8. The wireless communication device of claim 1, wherein said pole antenna comprises a dipole antenna and second communication electronics, said first communication electronics associated with one of said loops and said second communication electronics associated with said dipole antenna.

9. The wireless communication device of claim 1, wherein said pole antenna is positioned between said first loop conductor antenna and said second loop conductor antenna and capacitively couples to said first and second loop conductor antennas.

10. The wireless communication device of claim 1, wherein said pole antenna is positioned across said first and second loop conductor antennas.

11. The wireless communication device of claim 1, wherein said pole antenna comprises at least one tab.

12. The wireless communication device of claim 11, wherein said pole antenna further comprises a ground plane and said tab comprises a monopole antenna.

13. The wireless communication device of claim 11, wherein said pole antenna comprises two tabs to form a dipole antenna.

14. A wireless communication system comprising:
a first wireless communication device coupled to a loop conductor antenna operating at a first frequency;
a second wireless communication device coupled across said loop conductor antenna on one side of said first wireless communication device; and
said second wireless communication device couples to said loop conductor antenna including said first wireless communication device at a second operating frequency and couples to said loop conductor antenna excluding said first wireless communication device at a third operating frequency.

15. The wireless communication system of claim 14, further comprising an interrogator operating at one of said frequencies and interrogating one of said wireless communication devices.

16. The wireless communication system of claim 14, further comprising an article to be tracked by one of said wireless communication devices, said article attached to one of said wireless communication devices.

5 17. The wireless communication system of claim 14, wherein said first wireless communication device operates at 13.56 MHz.

18. The wireless communication system of claim 14, wherein said second wireless communication device operates at 868 MHz and 915 MHz.

10 19. The wireless communication system of claim 14, wherein said second wireless communication device further comprises a dipole antenna operating at a fourth frequency.

15 20. The wireless communication system of claim 19, wherein said dipole antenna operates at 2.45 GHz.

21. A method of tracking an item, comprising:

interrogating a wireless communication device at a first frequency through a first loop conductor antenna on the wireless communication device;

20 interrogating the wireless communication device at a second frequency through a dipole antenna on the wireless communication device; and

interrogating the wireless communication device at a third frequency through a second loop conductor antenna on the wireless communication device.

22. The method of claim 21, wherein interrogating the wireless communication device at a second frequency through a dipole antenna on the wireless communication device comprises interrogating the wireless communication device at a second frequency through a dipole antenna
5 capacitively coupled to said first and second loop conductor antennas.

23. The method of claim 21, wherein interrogating the wireless communication device at a second frequency through a dipole antenna on the wireless communication device comprises interrogating the wireless communication device at a second frequency through a dipole antenna
10 positioned across said first and second loop conductor antennas.

24. The method of claim 21, further comprising interrogating the wireless communication device at a fourth frequency through a third loop conductor antenna on the wireless communication device.

25. The method of claim 21, further comprising communicating from an interrogator to a central control system.

26. A transponder, comprising:
20 a dipole antenna;
a first loop conductor antenna;
a second loop conductor antenna, said first and second loop conductor antennas positioned on opposite sides of said dipole antenna and capacitively coupled thereto.

27. The transponder of claim 26, further comprising communication electronics communicatively coupled to said antennas.

28. The transponder of claim 26, wherein said dipole antenna is adapted to operate at 2.45 MHz, said first loop conductor antenna is adapted to operate at 915 MHz, and said second loop conductor antenna is adapted to operate at 868 MHz.

29. A wireless communication device comprising:

wireless communication electronics;

an asymmetrical dipole antenna operatively connected to said wireless communication electronics, said dipole antenna operative at a first frequency; and

at least one loop antenna capacitively coupled to said dipole antenna and operative at a second frequency.

30. The wireless communication device of claim 29 further comprising a second loop antenna capacitively coupled to said dipole antenna and operative at a third frequency.

31. The wireless communication device of claim 29 further comprising a ground plane operative with said dipole antenna.

32. The wireless communication device of claim 31 wherein said ground plane is slotted.

33. The wireless communication device of claim 29 wherein said dipole antenna is operative at a microwave frequency.

34. The wireless communication device of claim 29 wherein said at least one loop antenna is
5 operative at a low frequency.

35. The wireless communication device of claim 34 further comprising a second loop antenna operative at a UHF frequency and capacitively coupled to said dipole antenna.

36. The wireless communication device of claim 29 wherein said at least one loop antenna comprises a nested part to increase bandwidth reception on said at least one loop antenna.

37. A method of testing output from a wireless communication device comprising at least two sets of wireless communication electronics, said method comprising:

interrogating the wireless communication device at a first frequency to query one of said
at least two sets of wireless communication electronics;

interrogating the wireless communication device at a second frequency to query a second
one of said at least two sets of wireless communication electronics; and

comparing outputs received from said wireless communication device at said first and
20 second frequencies.

38. The method of claim 37 further comprising synchronizing said outputs.

39. The method of claim 38 wherein synchronizing said outputs comprises sending instructions to one of said wireless communication electronics to update information stored in memory associated therewith.

5 40. The method of claim 39 further comprising archiving both outputs.

41. The method of claim 40 further comprising comparing date stamps associated with each of said both outputs.

10 42. The method of claim 41 wherein sending instructions to one of said wireless communication electronics to update information stored in memory associated therewith comprises sending the output having the later date stamp to the wireless communication electronics whose output comprises the earlier date stamp.